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## **National Priority Chemicals Trends Report (2005-2007)**

### **Section 4 Trends Analyses for Specific Priority Chemicals (2005-2007): Phenanthrene**

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# Phenanthrene

## Chemical Information

**Alternate Names:** Phenanthrene

**General Uses:** Phenanthrene is obtained by fractional distillation of coal-tar oils and used in dyes, drugs, and explosives.

## How Much Phenanthrene Was Generated?

For 2007, 67 facilities reported generating approximately 1.4 million pounds of phenanthrene; one facility reported generating approximately 73 percent of the national total quantity of this PC (please refer to Exhibit 3.4 to see the number of facilities that reported this PC within various quantity ranges). Compared to the total quantities of phenanthrene reported for 2005 and 2006, the quantity decreased by approximately 65,000 pounds and decreased by 358,000 pounds, respectively (Exhibit 4.60).

**Exhibit 4.60. National Generation of Phenanthrene (2005–2007)**

| TRI Reporting Year                              | 2005      | 2006      | 2007      |
|---|-----------|-----------|-----------|
| Total Quantity of Phenanthrene (pounds)         | 1,430,252 | 1,726,564 | 1,365,563 |
| Number of TRI Facilities Reporting Phenanthrene | 60        | 64        | 67        |

## Where Was Phenanthrene Generated?

For 2007, facilities in 23 states reported generating phenanthrene. Exhibit 4.61 shows the counties in which facilities reported 98 percent of the total quantity of phenanthrene. Some observations concerning trends for the reported quantity of phenanthrene include:

- A petrochemical manufacturing facility in Iberville County, Louisiana (EPA Region 6) reported an increase of approximately 900,000 pounds for 2006; the facility did not generate phenanthrene in 2005.
- Of the two facilities in East Baton Rouge, Louisiana (Region 6) that had reported phenanthrene for 2005, one of the facilities – an organic chemical manufacturing facility – reported approximately 150,000 pounds for 2005 but did not report any phenanthrene for 2006 or 2007. In 2005, this facility had purchased fuel oil (from waste broker), containing phenanthrene – as an alternative source of energy for its boiler. The facility no longer used the fuel oil stream as an alternative fuel, starting in 2006.
- A primary aluminum production facility in Hancock County, Kentucky (EPA Region 4) reported a decrease of approximately 371,000 pounds for 2006 and none for 2007. This facility is a primary aluminum smelter and uses coal tar pitch and coke to produce carbon rods (anodes) for aluminum smelting. Phenanthrene is contained in the coal tar pitch. Quantities of phenanthrene reported correlate with the production of carbon rods. For 2007, the facility used a new vendor for the coal tar pitch in which phenanthrene was not a listed constituent.
- A petroleum refinery in Lake County, Indiana (EPA Region 5) reported a decrease of approximately 166,000 pounds for 2006. The facility developed a sampling plan to measure inlet and discharge concentrations for phenanthrene to obtain more accurate data around wastewater treatment plant emissions.

**Exhibit 4.61. Quantity of Phenanthrene, for Facilities Reporting 98 Percent of Total Quantity, by County (2007)**

| EPA Region   | State | County           | Quantity (pounds) of Phenanthrene |                  |                  | Percent of Total Quantity (2007) |
|--------------|-------|------------------|-----------------------------------|------------------|------------------|----------------------------------|
|              |       |                  | 2005                              | 2006             | 2007             |                                  |
| 6            | LA    | Iberville        | 0                                 | 910,207          | 1,000,249        | 73.2%                            |
| 4            | AL    | Jefferson        | 155,954                           | 89,431           | 94,052           | 6.9%                             |
| 6            | TX    | Brazoria         | 0                                 | 57,081           | 83,343           | 6.1%                             |
| 6            | TX    | Jefferson        | 30,834                            | 54,732           | 52,814           | 3.9%                             |
| 3            | WV    | Brooke           | 26,620                            | 37,676           | 20,065           | 1.5%                             |
| 5            | IL    | Cook             | 9,909                             | 11,089           | 18,903           | 1.4%                             |
| 3            | PA    | Allegheny        | 9,921                             | 5,923            | 17,883           | 1.3%                             |
| 6            | TX    | Harris           | 6,987                             | 34,689           | 16,646           | 1.2%                             |
| 5            | IN    | Lake             | 180,000                           | 14,000           | 14,100           | 1.0%                             |
| 5            | OH    | Trumbull         | 875                               | 1,197            | 10,234           | 0.7%                             |
| 5            | IL    | Grundy           | 168                               | 7,594            | 6,223            | 0.5%                             |
| 6            | LA    | East Baton Rouge | 154,198                           | 29,175           | 4,411            | 0.3%                             |
| <b>Total</b> |       |                  | <b>575,466</b>                    | <b>1,252,794</b> | <b>1,338,923</b> | <b>98.0%</b>                     |

## Which Industries Generated Phenanthrene?

For 2007, 67 facilities in 15 NAICS codes reported phenanthrene; 44 facilities in three NAICS codes reported 98 percent of the total quantity (Exhibit 4.62). One facility in NAICS code 325110 (Petrochemical manufacturing) reported generating approximately 73 percent of the national total quantity of phenanthrene for 2007.

**Exhibit 4.62. Industry Sectors Quantities of Phenanthrene (2005–2007)**

| Primary NAICS code | NAICS Code Description                      | Facilities Reporting (2007) | Quantity (pounds) of Phenanthrene |                  |                  | Percent of Total Quantity (2007) |
|--------------------|---|-----------------------------|-----------------------------------|------------------|------------------|----------------------------------|
|                    |   |                             | 2005                              | 2006             | 2007             |                                  |
| 325110             | Petrochemical Manufacturing                 | 10                          | 96,458                            | 1,103,911        | 1,132,793        | 83.0%                            |
| 325192             | Cyclic Crude and Intermediate Manufacturing | 3                           | 162,648                           | 96,178           | 108,613          | 8.0%                             |
| 324110             | Petroleum Refineries                        | 31                          | 233,094                           | 97,627           | 92,224           | 6.8%                             |
| <b>Total</b>       |   | <b>44</b>                   | <b>492,200</b>                    | <b>1,297,717</b> | <b>1,333,630</b> | <b>97.7%</b>                     |

## How Did Facilities Manage Phenanthrene?

Exhibit 4.63 shows how facilities, by industry, managed phenanthrene for 2007.

**Disposal:** Facilities disposed of approximately 9 percent of the phenanthrene generated. Facilities in NAICS code 325192 (Cyclic Crude and Intermediate Manufacturing) used disposal as the primary method of managing phenanthrene.

**Energy Recovery:** Facilities used energy recovery, mostly on site, to manage 77 percent of the phenanthrene generated. Facilities in NAICS code 325110 (Petrochemical Manufacturing) used energy recovery as the primary method of managing phenanthrene.

**Treatment:** Facilities treated approximately 14 percent of the phenanthrene generated. Petroleum refineries used treatment for approximately 90 percent of their phenanthrene.

In 2007, facilities also recycled approximately 863,000 pounds of phenanthrene. See Exhibit C.3 in Appendix C for additional information about the recycling of phenanthrene. Facilities also released approximately 31,000 pounds of phenanthrene as air emissions and surface water discharges in 2007. See Appendix D for additional information about releases of phenanthrene.

**Exhibit 4.63. Management Methods for Phenanthrene in Industry Sectors (2007)**

| Primary NAICS Code | NAICS Code Description                      | Total PC Quantity Reported | Quantity (pounds) of Phenanthrene |                |                  |               |                |               |              |                |
|--------------------|---|----------------------------|-----------------------------------|----------------|------------------|---------------|----------------|---------------|--------------|----------------|
|                    |   |                            | Disposal                          |                | Energy Recovery  |               | Treatment      |               | Recycling    |                |
|                    |   |                            | On-site                           | Off-site       | On-site          | Off-site      | On-site        | Off-site      | On-site      | Off-site       |
| 325110             | Petrochemical Manufacturing                 | 1,132,793                  | 0                                 | 31,235         | 1,000,000        | 383           | 88,296         | 12,880        | 0            | 31,235         |
| 325192             | Cyclic Crude and Intermediate Manufacturing | 108,613                    | 0                                 | 79,781         | 0                | 28,778        | 46             | 8             | 0            | 79,781         |
| 324110             | Petroleum Refineries                        | 92,224                     | 1,785                             | 3,923          | 62               | 3,350         | 74,175         | 8,927         | 1,785        | 3,923          |
| <b>Total</b>       |   | <b>1,333,630</b>           | <b>1,785</b>                      | <b>114,939</b> | <b>1,000,062</b> | <b>32,511</b> | <b>162,517</b> | <b>21,815</b> | <b>1,785</b> | <b>114,939</b> |

## Data Derived From Hazardous Waste Biennial Reports for Phenanthrene

In this section, we present data about phenanthrene contained in hazardous wastes, derived from information submitted by facilities in Biennial Reports under RCRA. We derived these data by applying a methodology to estimate the quantity of phenanthrene contained in BR waste streams. The estimates of phenanthrene contained in hazardous wastes supplement the data reported to TRI, providing a broader perspective regarding the industries that generate and manage wastes that contain phenanthrene. Based on applying our methodology to the 2007 BR data, we estimate that 294 facilities in 50 NAICS codes reported hazardous wastes, virtually all non-wastewater, containing approximately one million pounds of phenanthrene. Facilities in three industries: NAICS code 321114 (Wood Preservation), NAICS code 325192 (Cyclic Crude and Intermediate Manufacturing), and NAICS code 32411 (Petroleum Refineries) accounted for approximately 89 percent of the total estimated quantity of phenanthrene in the hazardous waste streams (Exhibit 4.64).

**Exhibit 4.64. Estimated Quantity of Phenanthrene in Primary Generation Hazardous Waste, by NAICS Code (2007)**

| Primary NAICS Code | NAICS Code Description                           | Number of Facilities | Quantity (pounds) of Phenanthrene |                 |                | Percent of Total Quantity |
|--------------------|--|----------------------|-----------------------------------|-----------------|----------------|---------------------------|
|                    |  |                      | Wastewaters                       | Non-Wastewaters | Total Quantity |                           |
| 321114             | Wood Preservation                                | 54                   | 3,826                             | 367,288         | 371,114        | 38.1%                     |
| 325192             | Cyclic Crude and Intermediate Manufacturing      | 5                    | 0                                 | 351,455         | 351,455        | 36.1%                     |
| 324110             | Petroleum Refineries                             | 139                  | 32                                | 146,175         | 146,207        | 15.0%                     |
| 331111             | Iron and Steel Mills                             | 5                    | 0                                 | 33,855          | 33,855         | 3.5%                      |
| 221210             | Natural Gas Distribution                         | 1                    | 0                                 | 23,222          | 23,222         | 2.4%                      |
| 325188             | All Other Basic Inorganic Chemical Manufacturing | 3                    | 0                                 | 18,130          | 18,130         | 1.9%                      |
| 812990             | All Other Personal Services                      | 1                    | 0                                 | 9,590           | 9,590          | 1.0%                      |
| <b>Total</b>       |  | <b>208</b>           | <b>3,858</b>                      | <b>949,715</b>  | <b>953,573</b> | <b>97.8%</b>              |

In 2007, facilities generated hazardous waste containing naphthalene in 194 counties within 45 states and territories. A facility in Jefferson County, Alabama (EPA Region 4) generated an estimated 36 percent of the phenanthrene contained in hazardous wastes (Exhibit 4.65).

**Exhibit 4.65. States and Counties in Which Facilities Generated 80 Percent of Phenanthrene Contained in Primary Generation Hazardous Waste (2007)**

| EPA Region   | State | County           | Estimated Quantity of Phenanthrene Contained in Hazardous Wastes (pounds) | Percent of Total Quantity of Phenanthrene Contained in Hazardous Wastes |
|--------------|-------|------------------|---|---|
| 4            | AL    | Jefferson        | 347,430   | 35.6%   |
| 6            | LA    | Caddo            | 80,368  | 8.2%  |
| 3            | WV    | Hampshire        | 79,560  | 8.2%  |
| 5            | IN    | Marion           | 23,222  | 2.4%  |
| 9            | CA    | Contra Costa     | 20,622  | 2.1%  |
| 6            | LA    | St Bernard       | 20,027  | 2.1%  |
| 5            | IN    | Lake             | 18,977  | 1.9%  |
| 6            | LA    | East Baton Rouge | 18,741  | 1.9%  |
| 4            | MS    | Grenada          | 15,989  | 1.6%  |
| 6            | TX    | Angelina         | 15,367  | 1.6%  |
| 5            | IN    | Pike             | 15,328  | 1.6%  |
| 4            | KY    | Todd             | 14,628  | 1.5%  |
| 5            | OH    | Trumbull         | 13,085  | 1.3%  |
| 6            | TX    | Jefferson        | 12,833  | 1.3%  |
| 6            | TX    | Grimes           | 10,883  | 1.1%  |
| 6            | LA    | Rapides          | 10,493  | 1.1%  |
| 10           | OR    | Lane             | 10,187  | 1.0%  |
| 6            | AR    | Pulaski          | 9,999   | 1.0%  |
| 6            | TX    | Jasper           | 9,928   | 1.0%  |
| 5            | OH    | Columbiana       | 9,590   | 1.0%  |
| 8            | CO    | Adams            | 8,834   | 0.9%  |
| 6            | TX    | Harris           | 8,570   | 0.9%  |
| 2            | NJ    | Burlington       | 8,309   | 0.9%  |
| <b>Total</b> |       |                  | <b>782,971</b>  | <b>80.3%</b>  |

Exhibit 4.66 shows how facilities reported managing hazardous wastes that contain phenanthrene. For example, facilities used fuel blending for hazardous wastes containing an estimated 448,000 pounds of phenanthrene. See Appendix E for a full list of the BR management codes and their descriptions.

**Exhibit 4.66. Methods Used to Manage Hazardous Wastes Containing Phenanthrene (2007)**

| Management Method Group   | Management Method Code Description                                   | Quantity of Phenanthrene Managed (2007) | Percent of Total Estimated Quantity of Phenanthrene |
|---|--|---|---|
| Reclamation and Recovery  | Fuel blending prior to energy recovery at another site               | 447,726                                 | 45.5%   |
|   | Energy recovery at this site   | 52,242                                  | 5.3%  |
|   | Other recovery or reclamation for reuse                              | 23,489                                  | 2.4%  |
|   | Metals recovery  | 8,823                                   | 0.9%  |
|   | Solvents recovery  | <1                                      | <0.1%   |
| <b>Reclamation and Recovery Total</b>                                   |  | <b>532,280</b>                          | <b>54.0%</b>  |
| Destruction or Treatment Prior to Disposal at Another Site              | Incineration   | 86,297                                  | 8.8%  |
|   | Other treatment  | 55,470                                  | 5.6%  |
|   | Stabilization or chemical fixation prior to disposal at another site | 37,092                                  | 3.8%  |
|   | Sludge treatment and/or dewatering                                   | 22,074                                  | 2.2%  |
|   | Chemical oxidation   | 83                                      | <0.1%   |
|   | Phase separation   | 20                                      | <0.1%   |
|   | Macro-encapsulation prior to disposal at another site                | 15                                      | <0.1%   |
|   | Cyanide destruction with or without precipitation                    | 1                                       | <0.1%   |
| <b>Destruction or Treatment Prior to Disposal at Another Site Total</b> |  | <b>201,055</b>                          | <b>20.4%</b>  |
| Transfer Off Site   | Storage, bulking, and/or transfer off site                           | 149,952                                 | 15.2%   |
| <b>Transfer Off Site Total</b>  |  | <b>149,952</b>                          | <b>15.2%</b>  |
| Disposal  | Landfill or surface impoundment that will be closed as landfill      | 86,833                                  | 8.8%  |
|   | Land treatment or application  | 8,757                                   | 0.9%  |
|   | Discharge to sewer/POTW or NPDES                                     | 3,799                                   | 0.4%  |
|   | Deepwell or underground injection                                    | 80                                      | <0.1%   |
| <b>Disposal Total</b>   |  | <b>99,469</b>                           | <b>10.1%</b>  |
| NA  | NA   | 2,188                                   | 0.2%  |
| <b>NA Total</b>   |  | <b>2,188</b>                            | <b>0.2%</b>   |
| <b>Grand Total</b>  |  | <b>984,945</b>                          | <b>100.0%</b>                                       |